JP 8-222374
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] By establishing an optical absorption diffusion layer with an organic luminous layer between the electrodes of a couple, or making it in more detail, what has optical absorption diffusibility for either of the electrodes of a couple about an organic electroluminescence (it being hereafter written as EL) element, this invention prevents the echo of outdoor daylight and relates to the organic EL device which raised contrast remarkably.
[0002]
[Description of the Prior Art] Since it has the features, like it is excellent in shock resistance since the EL element using electroluminescence has high visibility and is a perfect solid-state component because of self-luminescence, the utilization as a light emitting device in various displays attracts attention. Since there are an inorganic EL element which comes to use an inorganic compound for luminescent material, and an organic EL device which comes to use an organic compound in this EL element, among these an organic EL device can make applied voltage low substantially, that utilization research is positively made as a next-generation display device. The above-mentioned organic EL device is equipped with the organic compound layer which contains a luminous layer at least, and the electrode of the couple which pinches this organic compound layer, and, specifically, the thing of configurations, such as what prepared the hole-injection layer and the electron injection layer in this suitably on the basis of the configuration of an anode plate / luminous layer / cathode, for example, an anode plate / hole-injection layer / luminous layer / cathode, and an anode plate / hole-injection layer / luminous layer / electron injection layer / cathode, is known. This hole-injection layer has the function to transmit the electron hole poured in from the anode plate to a luminous layer, and the electron injection layer has the function to transmit the electron poured in from cathode to a luminous layer. And it is known that it will be accumulated in the interface of a hole-injection layer and a luminous layer since a hole-injection layer does not convey an electron, and luminous efficiency will go up the electron which many electron holes were poured into the luminous layer by lower electric field, and was further poured into the luminous layer from cathode or an electron injection layer by making this hole-injection layer intervene between a luminous layer and an anode plate.
[0003] In the organic EL device of such a configuration, if voltage is impressed to inter-electrode [of a couple], in a luminous layer, an exciton will arise by recombination with the electron poured in from cathode, and the electron hole poured in from the anode plate, and light will be emitted in the process in which this exciton carries out radiation deactivation. And at least one side is translucent among the electrodes of a couple, and light is emitted to the exterior through this transparence or translucent electrode. However, in the conventional organic EL device, since light was made to emit and this light was taken out from the transparence substrate side by impressing voltage to the organic stratum functionale which consists of an organic luminous layer, a hole-injection layer prepared by the case, an electron injection layer, etc. as described above, there was a problem that contrast fell remarkably, for example by the echo of the outdoor daylight

from metal system cathode. Moreover, there was same problem also in an inorganic EL element. The organic EL device which has an optical absorption diffusion layer on the outside of an electrode in order to solve such a problem is proposed (JP,6-5367,A). However, in this EL element, the metal system electrode needed to be thinly produced so that it might become translucent, and there was a problem that it did not escape that the impregnation nature of the charge from this electrode falls as a result. On the other hand, although the inorganic EL element which has an optical absorption layer or an optical absorption nature electrode is indicated (the international patent disclosure No. 14298 [94 to], 94-14299), since this inorganic EL element is the structure where the luminous layer was inserted into the insulating layer, the material currently indicated there is inapplicable to what emits light by impregnation of a charge like an organic EL device.
[0004]
[Problem(s) to be Solved by the Invention] This invention improves the defect which such a conventional organic EL device has, prevents the echo of outdoor daylight, and aims at offering the organic EL device which raised contrast remarkably.
[0005]
[Means for Solving the Problem] As a result of repeating research wholeheartedly that this invention persons should develop an organic EL device which raised contrast, it was translucent and either of the electrodes of a thing by which at least one established a charge impregnation nature optical absorption diffusion layer with an organic luminous layer between transparence or a translucent electrode of a couple, or a couple found out that transparence or a thing in which the remainder has optical absorption diffusibility might suit the object. This invention is completed based on this knowledge. At least one the first object of this invention namely, between transparence or a translucent electrode of a couple It is in offering an organic EL device which comes to pinch an organic luminous layer and a charge impregnation nature optical absorption diffusion layer. The second object It is in offering an organic EL device with which either of these electrodes is characterized by transparence or being translucent and the remainder having optical absorption diffusibility in an organic EL device which pinches an organic luminous layer between electrodes of a couple. An organic EL device of the first invention pinches an organic luminous layer and a charge impregnation nature optical absorption diffusion layer as an indispensable configuration layer between electrodes of a couple. In this element, an electrode of a up Norikazu pair needs to be transparence or for at least one side to be translucent, and since an organic EL device carries out the laminating of an electrode and each class and is usually produced on substrates, such as glass and a product made from plastics, only an electrode in contact with this substrate is required for being transparence or a substrate being translucent, transparence or to be translucent. The above-mentioned charge impregnation nature optical absorption diffusion layer is an operation which it has both functions of optical absorption diffusibility and charge impregnation nature, and optical absorption diffusibility says an operation which absorbs or diffuses the light here, and is passed to a charge impregnation layer which is [nature / charge impregnation] in contact with reception and an optical absorption diffusion layer from an electrode or a charge impregnation layer in an electron or an electron hole, and a luminous layer on the other hand. Since luminescence arises when it is poured in in an organic EL device to a luminous layer through a hole-injection layer in which an electron hole from an anode plate is established by case, and is poured in to a luminous layer

through an electron injection layer in which an electron from cathode is prepared by case on the other hand and an electron and an electron hole recombine here, it is required for an optical absorption diffusion layer established between two electrodes to also have charge impregnation nature. That is, to establish an optical absorption diffusion layer between cathode and a luminous layer, this optical absorption diffusion layer needs to have electronic impregnation nature at least among charge impregnation nature, and to prepare an optical absorption diffusion layer in reverse between an anode plate and a luminous layer, this optical absorption diffusion layer needs to have the impregnation nature of an electron hole at least among charge impregnation nature.

[0006] Although there are various modes in an organic EL device of this first invention For example, it sets to the conventional organic EL device which pinches organic stratum functionale which contains an organic luminous layer as an indispensable configuration layer between electrodes of (1) couple. Between electrodes of a thing which established a charge impregnation nature optical absorption diffusion layer further between electrodes of a couple, and (2) couples In the conventional organic EL device which pinches organic stratum functionale containing an organic luminous layer, and a hole-injection layer and/or an electron injection layer, what gave a function of optical absorption diffusibility to a hole-injection layer and/or an electron injection layer can be mentioned as a desirable mode. About a configuration of an organic EL device in a mode of the above (1) Although there is especially no limit, for example that what is necessary is just the thing of a configuration of pinching an organic luminous layer and a charge impregnation nature optical absorption diffusion layer as an indispensable configuration layer between electrodes of a couple between electrodes of a couple (a) A thing which comes to pinch an organic luminous layer, (b) hole-injection layer and/or an electron injection layer, and (c) charge impregnation nature optical absorption diffusion layer can be mentioned preferably. As an example of such a thing, what prepared a charge impregnation nature optical absorption diffusion layer in a suitable location between an anode plate and cathode can be mentioned in element configurations, such as ** anode plate / organic luminous layer / cathode, ** anode plate / hole-injection layer / organic luminous layer / cathode, ** anode plate / organic luminous layer / electron injection layer / cathode, and ** anode plate / hole-injection layer / organic luminous layer / electron injection layer / cathode. Although the laminating of these is usually carried out on substrates, such as glass and a product made from plastics, there is especially no limit about built-up sequence to a substrate, a laminating may be carried out from an anode plate, or a laminating may be carried out from cathode.

[0007] In an organic EL device of these configurations, as a desirable thing, especially A (b) anode plate / hole-injection layer / optical absorption diffusion layer / organic luminous layer / cathode, A (b) anode plate / hole-injection layer / optical absorption diffusion layer / organic luminous layer / electron injection layer / cathode, An anode plate / optical absorption diffusion layer / hole-injection layer / organic luminous layer / cathode, a (d) anode plate / optical absorption diffusion layer / hole-injection layer / organic luminous layer / electron injection layer / cathode, (Ha) (e) A thing of a configuration of an anode plate / hole-injection layer / organic luminous layer / optical absorption diffusion layer / cathode, a (**) anode plate / hole-injection layer / organic luminous layer / electron injection layer / optical absorption diffusion layer / cathode, or a (g) anode plate / hole-injection layer / organic luminous layer / optical absorption

possible configurations

diffusion layer / electron injection layer / cathode can be mentioned. In an organic EL device of the above-mentioned element configuration, an anode plate is transparence or a translucent electrode, and when cathode is a metal system electrode, a configuration of the above-mentioned (e), (**), and (g) is advantageous. It is because, as for this reason, an optical absorption diffusion layer carries out absorption dispersion only of the outdoor daylight with a configuration of (e), (**), and (g) and luminescence of an organic EL device is observed from a direct transparent electrode. Conversely, transparence or when taking out light from a cathode side, a configuration of the above-mentioned (**), (**), or (Ha) (d) has cathode advantageous [it is translucent, and]. Moreover, a hole-injection layer and an electron injection layer may consist of a layer of itself plurality so that it may mention later. Therefore, it may be inserted between charge impregnation layers like an anode plate / the 1st hole-injection layer / optical absorption diffusion layer / 2nd hole-injection layer. Drawing 1 is the cross section showing an example of an element configuration in case an anode plate is transparence or a translucent electrode and cathode is a metal system electrode in an organic EL device of this invention, and the laminating of the cathode 6 which consists of transparence or the translucent anode plate 2, the hole-injection layer 3, the organic luminous layer 4, an optical absorption diffusion layer 5, and a metal system electrode on the transparence substrate 1 is carried out one by one.

[0008] Next, an organic EL device in a mode of the above (2) will give a function of optical absorption diffusibility to a hole-injection layer and/or an electron injection layer, a hole-injection layer will have both functions of hole-injection nature and optical absorption diffusibility, and an electron injection layer will have both functions of electron injection nature and optical absorption diffusibility. although there are various things as a configuration of such an organic EL device -- (**) -- an anode plate / optical absorption diffusibility hole-injection layer / organic luminous layer / cathode, an anode plate (Li) / an optical absorption diffusibility hole-injection layer / organic luminous layer / electron injection layer / cathode, a (j) anode plate / organic luminous layer / optical absorption diffusibility electron injection layer / cathode, a (**) anode plate / a hole-injection layer / organic luminous layer / optical absorption diffusibility electron injection layer / cathode can be mentioned. the reason as the above nil why it is the same when an anode plate is transparence or a translucent electrode and cathode is a metal system electrode in an organic EL device of the above-mentioned element configuration -- a configuration of the above-mentioned (**) and (**) -- advantageous -- reverse -- cathode -- transparence or a case where it is translucent and light is taken out from a cathode side -- the above-mentioned (**) -- a configuration of and (Li) is advantageous. The above-mentioned optical absorption diffusibility hole-injection layer and an optical absorption diffusibility electron injection layer are producible by making a hole-injection layer and an electron injection layer contain optical absorption diffusibility matter.

[0009] As matter which has a function of both charge impregnation nature which forms a charge impregnation nature optical absorption diffusion layer, and optical absorption diffusibility in an organic EL device of this invention When preparing this optical absorption diffusion layer in a cathode side from an organic luminous layer, n-SiC and a graphite are begun. As mixture of a metallic oxide and a metal of 4.0eV or less of work functions mentioned later, mixture of a metallic oxide and an organic compound preferably used for an electron injection layer mentioned later, a metal of 4.2eV or less of

metallic oxide diffusion layer

work functions, and an electron injection layer mentioned later Mixture (it is specifically the mixture of aluminum and tris (8-hydroxyquinoline) aluminum etc.) with an organic compound used preferably, an ultra-fine particle (mean particle diameter of about 100 micrometers or less) of 4.0eV or less of work functions, etc. are mentioned. Furthermore, a general formula (I)
[0010]
[Formula 1]

[0011] Among [type, in R, an alkyl group and M show alkaline earth metal, such as alkali metal, such as sodium and a potassium, or calcium, and n shows the valence of M.] It can come out and the compound (water of crystallization may be included) expressed can be used, and the vacuum deposition film of this compound absorbs the light as indicated by JP,64-17849,A. Two or more sorts of these matter may be combined, and it may be used. In the compound which has the function of both the above-mentioned charge impregnation nature and optical absorption diffusibility, the mixture of the metal of the mixture of a metallic oxide and the organic compound used for an electron injection layer and 4.2eV or less of work functions and the organic compound used for an electron injection layer can be used also for formation of the optical absorption diffusibility electron injection layer in the mode of the above (2). On the other hand, when preparing an optical absorption diffusion layer in an anode plate side from an organic luminous layer, as matter which has the function of both charge impregnation nature and optical absorption diffusibility For example, mixture with the metal of 4.0eV or more of work functions which begin a graphite and are later mentioned with a metallic oxide, The mixture of a metallic oxide and the organic compound preferably used for the hole-injection layer mentioned later, the mixture of the metal of 4.2eV or more of work functions, and the organic compound preferably used for the hole-injection layer mentioned later, the ultra-fine particle of 4.0eV or more of work functions (mean particle diameter of about 100 micrometers or less), Or the compound which has absorption in the lights, such as polyacethylene, is mentioned. Moreover, two or more sorts of these matter may be combined, and it may be used. In the compound which has the function of both the above-mentioned charge impregnation nature and optical absorption diffusibility, the mixture of the metal of the mixture of a metallic oxide and the organic compound used for a hole-injection layer and 4.2eV or more of work functions and the organic compound used for a hole-injection layer can be used also for formation of the optical absorption diffusibility hole-injection layer in the mode of the above (2).
[0012] Although there is especially no limit, and it can choose suitably from a spin coat method, the cast method, vacuum deposition, etc. and can use according to the matter to be used about the production method of the optical absorption diffusion layer in the organic EL device of this invention, especially a vacuum deposition method is suitable. When it is easy to obtain a homogeneous film, if this is produced by the same method from it being desirable for an organic luminous layer, a hole-injection layer, and an electron injection layer to produce with a vacuum deposition method like the after-mentioned, it can be produced without breaking a vacuum, economization of production

time amount or an effort is possible for it, and it is because mixing of an impurity can be prevented. Although vacuum evaporationo conditions differ according to the class of matter used for an optical absorption diffusion layer when adopting this vacuum deposition method, in the case of an organic compound, generally, 50-500 degrees C and a degree of vacuum can be chosen by 10-6 - 10-3Pa, and heating temperature can choose an evaporation rate suitably a second in the range with 0.01-50nm [/] and a substrate temperature of 50-300 degrees C. On the other hand, in the case of inorganic substances [, such as a metal, a metallic oxide, and a graphite,], heating temperature usually becomes high with 500-4,000 degrees C. Especially a thing high-melting [, such as a graphite,] has the sputtering method which can produce a high-melting thing also in vacuum deposition, electron beam vacuum deposition, and desirable arc vacuum deposition among inorganic substances. Thus, although there is especially no limit about the thickness of the acquired optical absorption diffusion layer, the range of 10nm - 100 micrometers is desirable, and the range which is 10nm - 1 micrometer is especially suitable, and it is **.

[0013] Next, the organic EL device of the second invention pinches an organic luminous layer as an indispensable configuration layer between the electrodes of a couple, and it is translucent and either of these electrodes is transparence or the thing in which the remainder has optical absorption diffusibility. In order to give optical absorption diffusibility to an electrode, in the case of cathode, an electrode should just be produced with the mixture of the matter and the metal of 4.0eV or less of work functions which have optical absorption diffusibility. Here, as a metal of 4.0eV or less of work functions, rare earth metals, such as calcium, Li, Yb, Na, Y, Gd, Ba, Cs, Sr, and Mg, alkali metal, and alkaline earth metal are mentioned, for example. As an example of such cathode, the mixed electrode of the mixed electrode metallurgy group oxide of a graphite and Li and calcium etc. can be mentioned. On the other hand, in the case of an anode plate, an electrode should just be produced with the mixture of the matter and the metal of 4.0eV or more of work functions which have optical absorption diffusibility. As a metal of 4.0eV or more of work functions, Au, nickel, Ag, Pt, Cu, etc. are mentioned, for example. The thing same as a configuration of the organic EL device of this second invention as what was illustrated by the aforementioned ** - ** can be mentioned.

electrode has diffuse nature

Al = 4.26

[0014] Drawing 2 is the cross section showing the configuration of an example at the time of giving optical absorption diffusibility to cathode in the organic EL device of this invention, and the laminating of transparence or the translucent anode plate 2, the hole-injection layer 3, the organic luminous layer 4, and optical absorption diffusibility cathode 6' is carried out one by one on the transparence substrate 1. Next, in the organic EL device of this invention, each class other than what was explained until now is explained. First, what uses a large (4eV or more) metal, an alloy, electrical conductivity compounds, such mixture, etc. of a work function as electrode material as an anode plate is used preferably. As an example of such electrode material, dielectric transparent materials, such as metals, such as Au, CuI, indiumtinoxide (it is hereafter written as ITO), SnO2, and ZnO, etc. are mentioned. This anode plate can produce such electrode material by making a thin film form by methods, such as vacuum evaporationo and sputtering. When taking out luminescence from this electrode, it is desirable to make permeability larger than 10%, and below hundreds of ohms / ** of the sheet resistance as an electrode are desirable. Although thickness is furthermore based also on a material, the range of 10-

200nm is usually especially desirable 10nm - 1 micrometer.
[0015] What, on the other hand, uses a small (4eV or less) metal, an alloy, electrical conductivity compounds, such mixture, etc. of a work function as electrode material as cathode is used. As an example of such electrode material, a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium and a silver alloy, aluminum/AlO2, an indium, a rare earth metal, etc. are mentioned. By methods, such as vacuum evaporationo and sputtering, this cathode can produce such electrode material by making a thin film form. Moreover, below hundreds of ohms / ** of the sheet resistance as an electrode are desirable, and especially thickness usually has the desirable range of 50-200nm 10nm - 1 micrometer. In addition, in the organic EL device of the first invention, it is required to be transparence or for either [at least] the above-mentioned anode plate or cathode to be translucent, and it is required in the organic EL device of the second invention transparence or for either an anode plate and cathode to have optical absorption diffusibility, as it is translucent and the remainder described above.
[0016] Moreover, an organic luminous layer provides the interior of a luminous layer with the field of recombination of the impregnation function to in_which an electron hole can be poured in by the anode plate or the hole-injection layer at the time of (1) electric-field impression, and an electron can be poured into it from cathode or an electron injection layer, the transport function, to which the charge (an electron and electron hole) which carried out (2) impregnation is moved by the force of electric field, (3) electrons, and an electron hole, and has the luminescence About the class of luminescent material used for this luminous layer, there is especially no limit and a thing conventionally well-known as an organic luminescent material in an organic EL device can be used. As an example of such an organic luminescent material, fluorescent brighteners, such as a benzothiazole system, a benzimidazole system, and a benzo oxazole system, a metal chelation oxy-NOIDO compound, a styryl benzenoid compound, a JISUCHIRIRU pyrazine derivative, an aromatic series dimethylidyne compound, etc. are mentioned. An organic luminous layer is formed only with an organic luminescent material, and also it may be formed with mixture with an organic luminescent material, an electron hole transport material, and/or an electron injection material etc. As an example of the material of the organic luminous layer in this case The molecular dispersion polymer system which carried out little distribution of the organic luminescent material, such as a coumarin, into polymer, such as polymethylmethacrylate, bisphenol A, and a polycarbonate (PC), The polymer system which introduced the JISUCHIRIRU benzene derivative into the polycarbonate frame, Or polyphenylene vinyl A derivative system, the poly alkyl thiophene (PPV) In conjugation polymer, such as a derivative system, the poly alkyl fluorene (PAF) derivative system, a polyphenylene (PP) derivative system, and the poly (propine PA) derivative system, and the polyvinyl carbazole of electron hole transportability, (PAT) The OKISA diazole system derivative of electron injection nature The distributed system is mentioned.
[0017] Next, a hole-injection layer is a layer which consists of an electron hole transfer compound, it has the function to transmit the electron hole poured in from the anode plate to a luminous layer, and many electron holes are poured into a luminous layer by lower electric field by making this hole-injection layer intervene between an anode plate and a luminous layer. Moreover, the electron poured into the luminous layer by cathode or the electron injection layer is accumulated near the interface in this luminous layer with the

obstruction of the electron which exists in the interface of a luminous layer and a hole-injection layer, raises the luminous efficiency of an EL element, and let it be the EL element which was excellent in the luminescence engine performance. About the electron hole transfer compound used for this hole-injection layer, there is especially no limit and it can use a thing conventionally well-known as an electron hole transfer compound in an organic EL device. as the example of such an electron hole transfer compound -- a triazole derivative, an OKISA diazole derivative, an imidazole derivative, the poly aryl alkane derivative, a pyrazoline derivative, a pyrazolone derivative, a phenylenediamine derivative, an arylamine derivative, an amino substitute chalcone derivative, an oxazole derivative, a styryl anthracene derivative, and full -- me -- non, specific conductive polymer oligomer, such as a derivative, a hydrazone derivative, a stilbene derivative, a silazane derivative, a polysilane system compound, an aniline system polymer, and thiophene oligomer,

[0018] Furthermore, the electron injection layer has the function to transmit the electron poured in from cathode to an organic luminous layer. About the electron transport compound used for this electron injection layer, there is especially no limit and it can use a thing conventionally well-known as an electron transport compound in an organic EL device. As an example of such an electron transport compound nitration full -- me -- non -- heterocycle tetracarboxylic acid anhydrides, such as a derivative, an anthra quinodimethan derivative, a diphenyl quinone derivative, a thiopyran dioxide derivative, and naphthalene perylene, a carbodiimide, a full ORENIRIDEN methane derivative, and an anthrone derivative -- To an OKISA diazole derivative and a pan, an eight quinolinol or the metal complex of the derivative, For example, tris Aluminum, a screw (Eight quinolinol) Magnesium, a screw (Eight quinolinol) Zinc, a screw (Benzo-8-quinolinol) (2-methyl-8-quinolilato)aluminumoxide, a tris (eight quinolinol) indium, tris (5-methyl-eight quinolinol) aluminum, an eight-quinolinol lithium, a tris (5-chloro-eight quinolinol) gallium, a screw Calcium, tris (5, 7-dichloro-eight quinolinol) aluminum, tris (5, 7-dibromo-eight quinolinol) aluminum, screw (eight quinolinol) beryllium, (5-chloro-eight quinolinol) Screw (2-methyl-eight quinolinol) beryllium, screw (eight quinolinol) zinc, screw (2-methyl-eight quinolinol) zinc, screw (eight quinolinol) tin, tris (7-propyl-eight quinolinol) aluminum, etc. are mentioned. In addition, the above-mentioned organic luminous layer, a hole-injection layer, and an electron injection layer may carry out the laminating of the layer which consists of a material which may consist of one layer which consists of kinds of each material, or two sorts or more, or is different more than a bilayer.

[0019] Next, about the suitable production method of the organic EL device of this invention, the element which has the configuration of an anode plate / hole-injection layer / organic luminous layer / electron injection layer / optical absorption diffusion layer / cathode is mentioned as an example, and is explained. First, on a suitable substrate, 1 micrometer or less of thin films which consist of desired electrode material, for example, matter for anode plates, is made to form by methods, such as vacuum evaporationo and sputtering, so that it may become the thickness of the range of 10-200nm preferably, and an anode plate is produced. Next, sequential formation of the thin film which consists of a material of the hole-injection layer which is an element material, an organic luminous layer, an electron injection layer, and an optical absorption diffusion layer on this is carried out. Although production of an optical absorption diffusion layer was already

described, as the production method of other thin films, there are a spin coat method, the cast method, vacuum deposition, etc. However, the point of a homogeneous film being easy to be obtained and being hard to generate a pinhole to a vacuum deposition method is desirable. When adopting this vacuum deposition as this thin film-ization, although it changes with crystal structures, meeting structures, etc. which are made into the class of compound to be used, and the object of a molecule deposition film, as for that vacuum evaporationo condition, it is desirable to choose suitably generally in the boat heating temperature of 50-500 degrees C, a degree of vacuum 10-6 - 10-3Pa, the evaporation rate of 0.01-50nm/second, the substrate temperature of -50-300 degrees C, and the range of 5nm A desired EL element is obtained by making the thin film which consists of matter for cathode on it form by methods, such as vacuum evaporationo and sputtering, after formation of these layers, so that 1 micrometer or less may become the thickness of the range of 50-200nm preferably, and preparing cathode. In addition, in production of this EL element, it is also possible to make production sequence into reverse and to produce it in order of cathode, an optical absorption diffusion layer, an electron injection layer, an organic luminous layer, a hole injection layer, and an anode plate.

[0020] moreover, as the production method of the element which consists of the anode plate / mixolimnion / an optical absorption diffusion layer / cathode pinched in the form where it made inter-electrode [of a couple] mix a hole-injection layer, an organic luminous layer, and an electron injection layer For example, [whether the solution which forms the thin film which consists of matter for anode plates on a suitable substrate, and consists of binders, such as a hole-injection material, luminescent material, an electron injection material, a polyvinyl carbazole, a polycarbonate, polyarylate, polyester, and a polyether, etc. is applied and] Or there is a thing in which make a thin film form with a dip painting method of construction from this solution, consider as a mixolimnion, form an optical absorption diffusion layer on it, and the thin film which consists of matter for cathode further is made to form. Thus, luminescence can be observed, if + is impressed for an anode plate and it impresses about voltage 5-40V for cathode as polarity of -, in impressing direct current voltage to the obtained organic EL device. Moreover, even if it impresses voltage with the polarity of reverse, luminescence is not produced at all, without current flowing. Furthermore, in impressing alternating voltage, only when a positive electrode changes + and a negative electrode changes into the condition of -, it emits light. In addition, the wave of the alternating current to impress is arbitrary and good.

[0021]

[Example] Next, although an example explains this invention in more detail, this invention is not limited at all by these examples.

What produced the ITO electrode in thickness of 100nm on the glass substrate of example 125mmx75mmx1.1mm size was used as the transparence support substrate. After cleaning this ultrasonically for 30 minutes by isopropyl alcohol, pure water washed for 30 minutes and, finally it cleaned ultrasonically for 30 minutes by isopropyl alcohol again. Next, it fixed to the substrate electrode holder of the vacuum evaporator [the product made from Japanese Vacuum technology] of marketing of this transparence support substrate, N, N'-diphenyl-N, N'-screw-(3-methylphenyl)-[1 and 1'-biphenyl]-4, and 4'-diamine (TPD) 200mg were put into the resistance heating boat made from molybdenum, and 200mg (Alq) of tris (8-hydroxyquinoline) aluminum complexes was

put into another resistance heating boat made from molybdenum. Moreover, the graphite was set in arc vacuum evaporationo equipment. After decompressing the inside of a vacuum chamber up to 1x10 to 4 Pa, heated the boat containing TPD, TPD was made to deposit on a substrate, and the hole-injection layer of 60nm of thickness was formed. Subsequently, 60nm laminating vacuum evaporationo was carried out from another boat, having used Alq as the luminous layer. Besides 30nm of graphites was made to deposit with arc vacuum deposition, and the optical absorption diffusion layer was established.
[0022] Next, the mask made from a stainless steel was installed on ejection and the above-mentioned luminous layer from the vacuum tub, and this was again fixed to the substrate electrode holder. After putting silver wire 0.5 g into the basket made from a tungsten and putting magnesium ribbon 1g into another boat made from molybdenum, the inside of a vacuum tub was decompressed up to 1x10 to 4 Pa, magnesium and silver were vapor-deposited by the atomic ratio 10:1, and the cathode was produced. Thus, it was 80 when contrast was searched for by the method shown below about the obtained element.
<the measuring method of contrast> -- while turning the luminescence side up and placing the element on the predetermined base under fluorescent lamp burning in the usual laboratory first, the incandescent lamp (100W) has been arranged in distance of about 50cm on the slant of this element. and the brightness at the time of impressing the voltage of 9V to an element, turning on an incandescent lamp, and making this element emit light and brightness when not impressing voltage to an element -- a color color difference meter (CS[by Minolta Camera Co., Ltd.]- 100) -- measuring -- brightness][at the time of formula contrast =[voltage impression (at the time of luminescence)]/[brightness when not impressing voltage (at the time of un-emitting light)]
Contrast was computed more. In addition, the optical environment at the time of the measurement of luminance imitates the typical optical environment at the time of an organic EL device being used actually.
[0023] It was made to deposit to an Alq layer like an example 1 except having not prepared an example 2 graphite layer. Next, the lithium was put into the boat made from molybdenum, and the graphite was set in the arc evaporator, it decompressed to the 1x10 to 4 Pa degree of vacuum, vapor codeposition of a lithium and the graphite was carried out so that it might become an atomic ratio 1:99, and the mixed electrode (cathode which has Li concentration 1 atom % and optical absorption diffusibility) of a lithium and a graphite was prepared on the Alq layer. Thus, it was 78 when contrast was searched for like the example 1 about the obtained element.
[0024] In example of comparison 1 example 1, except having not established an optical absorption diffusion layer (graphite layer), when the organic EL device was produced like the example 1 and the contrast was searched for, it was 11 and was remarkably low compared with the element obtained in the example 1 and the example 2.
[0025]
[Effect of the Invention] By establishing an optical absorption diffusion layer with an organic luminous layer between the electrodes of a couple, or making it what has optical absorption diffusibility for either of the electrodes of a couple, the organic EL device of this invention prevents the echo of outdoor daylight, and raises contrast remarkably. The organic EL device of this invention is suitably used as a light emitting device in various displays.

0.：1で蒸着して陰電極を作製した。このようにして得られた素子について、以下に示す方法によりコントラストを求めたところ、８０であった。

＜コントラストの測定方法＞まず、通常の実験室内の蛍光灯点灯下で、所定の台上に発光面を上にして素子を置くとともに、この素子の斜め上約５０ｃｍの距離に白熱電球（１００Ｗ）を配置した。そして、白熱電球を点灯しながら、素子に９Ｖの電圧を印加して、該素子を発光させたときの輝度と、素子に電圧を印加していないときの輝度とを、色彩色差計（ミノルタカメラ社製ＣＳ－１００）により測定し、式

コントラスト＝〔電圧印加時（発光時）の輝度〕／〔電圧を印加していないとき（非発光時）の輝度〕

よりコントラストを算出した。なお、輝度測定時の光学的環境は、有機ＥＬ素子が実際に使用される際の代表的な光学的環境を模したものである。

【００２３】実施例２

黒鉛層を設けなかったこと以外は、実施例１と同様にしてＡｌｑ層まで堆積させた。次にモリブデン製ボートにリチウムを入れ、黒鉛をフーク蒸発装置にセットし、真空度１×１０$^{-4}$Ｐａに減圧してリチウムと黒鉛を、原子比１：９９になるように共蒸着し、リチウムと黒鉛の混合電極（Ｌｉ濃度１原子％，光吸収拡散性を有する陰電極）をＡｌｑ層の上に設けた。このようにして得られた素子について、実施例１と同様にしてコントラストを求めたところ、７８であった。

【００２４】比較例１

実施例１において、光吸収拡散層（黒鉛層）を設けなかったこと以外は、実施例１と同様にして有機ＥＬ素子を作製し、そのコントラストを求めたところ、１１であり、実施例１及び実施例２で得られた素子に比べて、著しく低かった。

【００２５】

【発明の効果】本発明の有機ＥＬ素子は、一対の電極の間に有機発光層と共に光吸収拡散層を設けるか、又は一対の電極のいずれか一方を光吸収拡散性を有するものにすることにより、外光の反射を防止し、コントラストを著しく向上させたものである。本発明の有機ＥＬ素子は、各種表示装置における発光素子として好適に用いられる。

【図面の簡単な説明】

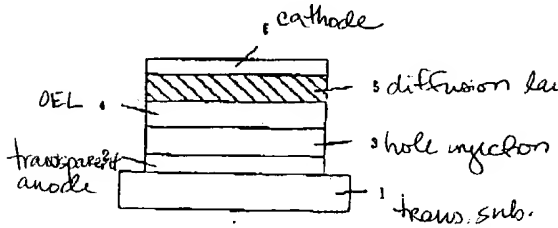
【図１】　本発明の有機ＥＬ素子の一例の構成を示す断面図である。

【図２】　本発明の有機ＥＬ素子の別の例の構成を示す断面図である。

【符号の説明】

１：透明基板
２：透明又は半透明の陽極
３：正孔注入層
４：有機発光層
５：光吸収拡散層
６：陰極
６’：光吸収拡散性陰極

【図１】



【図２】